

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (U-MOSVI-H)

TK50P03M1

High-Efficiency DC-DC Converter Applications
Desktop PC Applications

Unit: mm

- High-speed switching
- Small gate charge: $Q_{SW} = 8.2 \text{ nC (typ.)}$
- Low drain-source ON-resistance: $R_{DS(ON)} = 5.8 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance: $|Y_{fs}| = 90 \text{ S (typ.)}$
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A (max)}$ ($V_{DS} = 30 \text{ V}$)
- Enhancement mode: $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 0.2 \text{ mA}$)

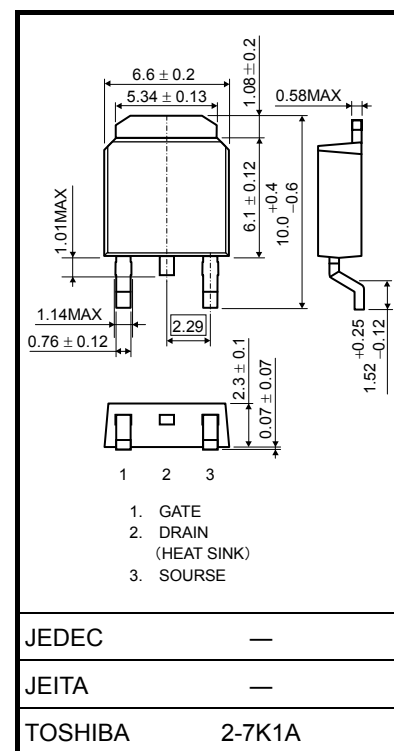
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	50	A
	Pulsed (Note 1)	I_{DP}	150	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	60	W
Single-pulse avalanche energy (Note 2)		E_{AS}	65	mJ
Avalanche current		I_{AR}	50	A
Repetitive avalanche energy ($T_c = 25^\circ\text{C}$) (Note 3)		E_{AR}	5.2	mJ
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 150	$^\circ\text{C}$

Note: For Notes 1 to 3, refer to the next page.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

This transistor is an electrostatic-sensitive device. Handle with care.

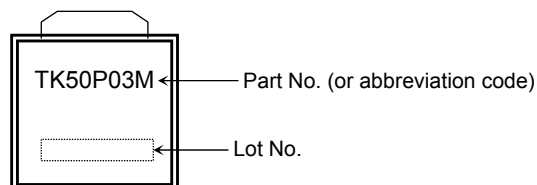


Weight: 0.36 g (typ.)

Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	2.08	$^{\circ}\text{C} / \text{W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	125	$^{\circ}\text{C} / \text{W}$

Marking (Note 4)

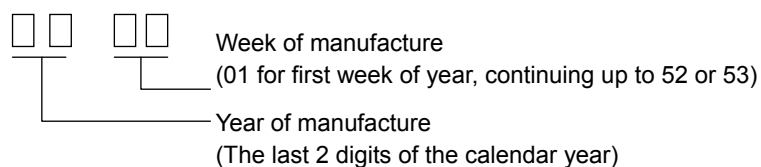


Note 1: The channel temperature should not exceed 150°C during use.

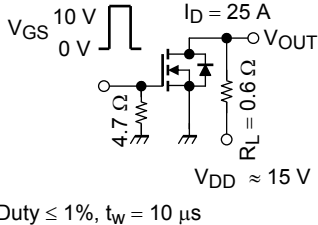
Note 2: $V_{DD} = 24 \text{ V}$, $T_{ch} = 25^{\circ}\text{C}$ (initial), $L = 20 \mu\text{H}$, $R_G = 25 \Omega$, $I_{AR} = 50 \text{ A}$

Note 3: Repetitive rating: pulse width limited by maximum channel temperature

Note 4: * Weekly code: (Four digits)

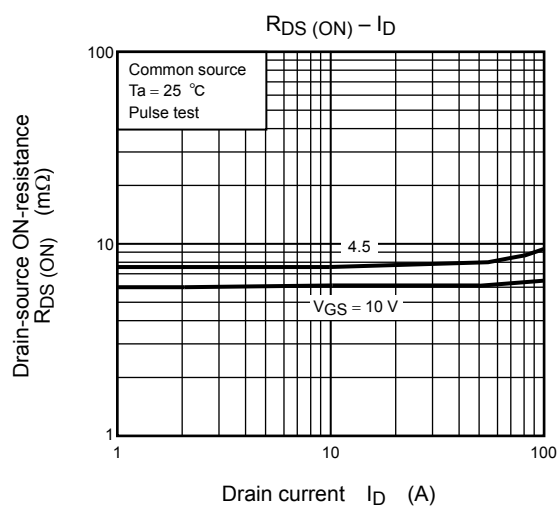
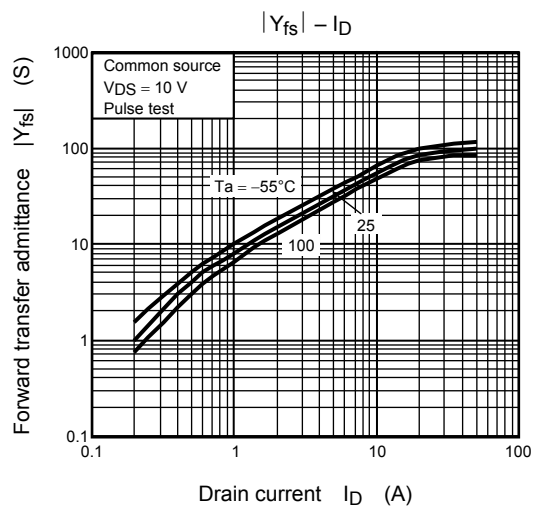
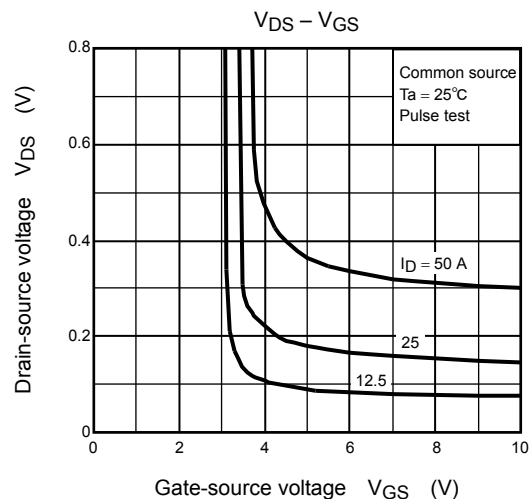
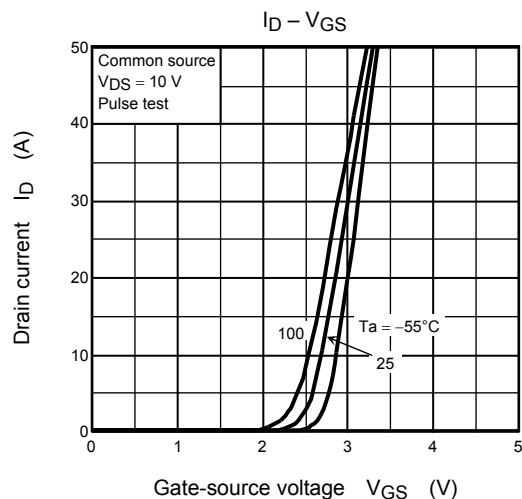
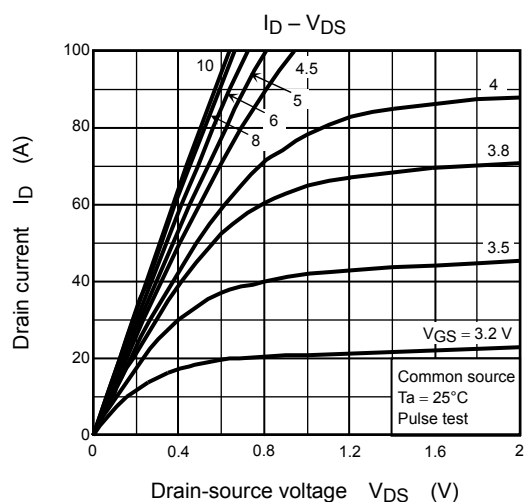
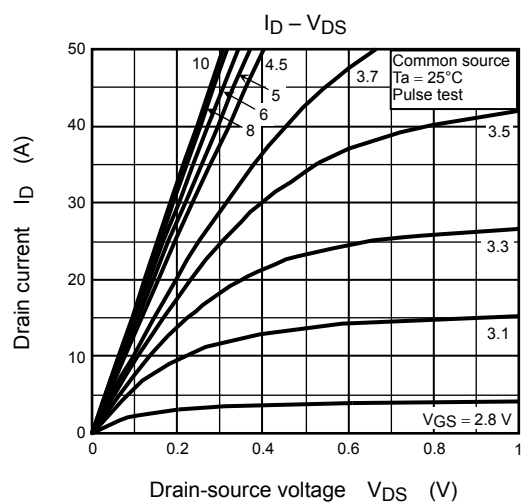


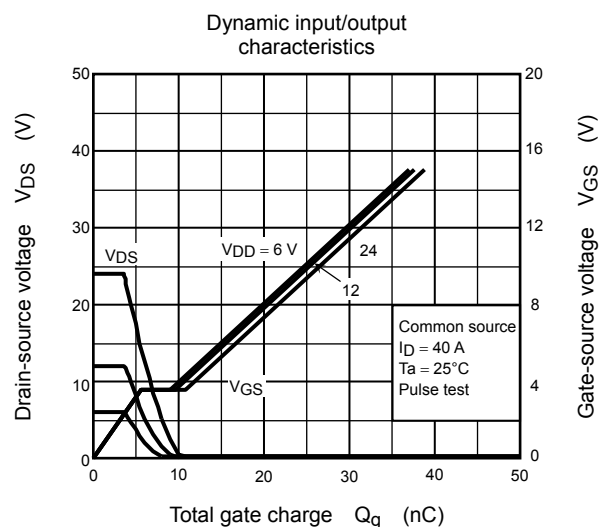
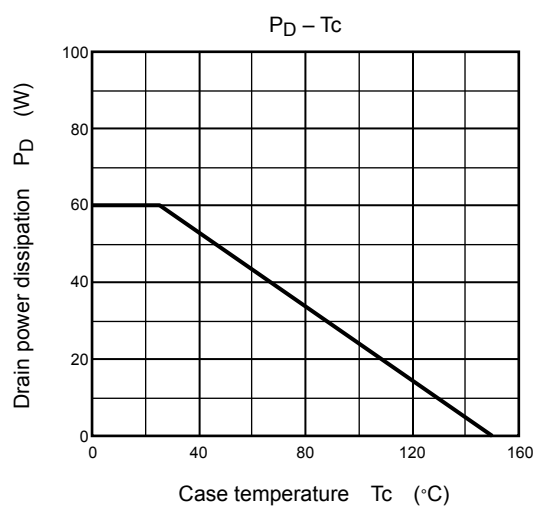
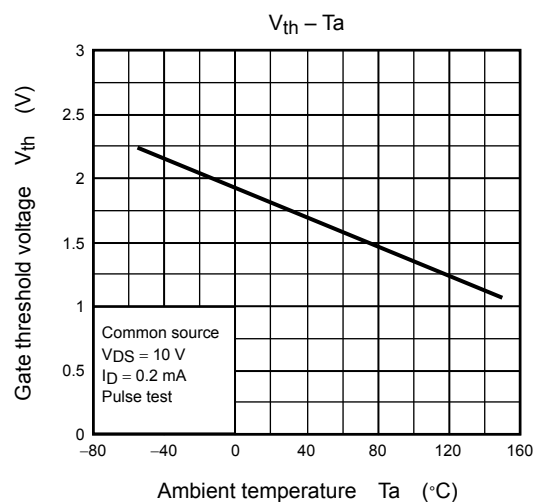
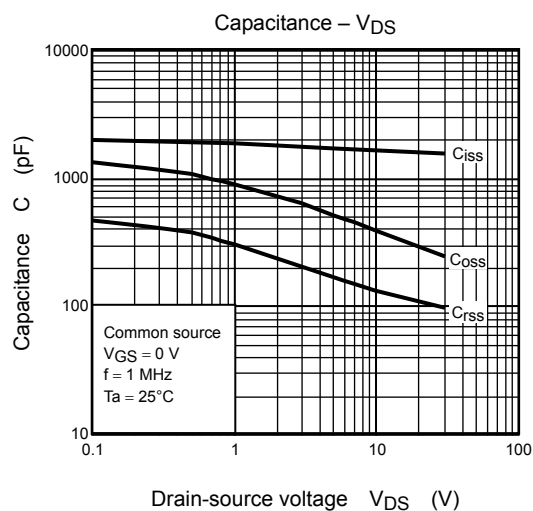
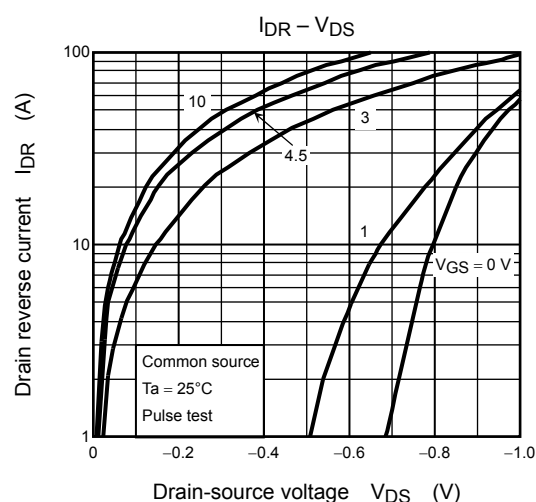
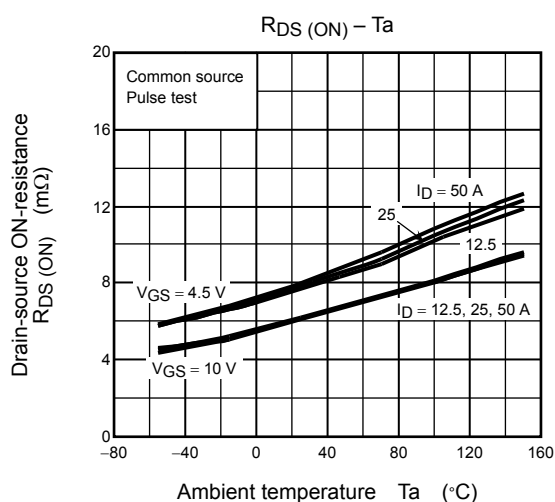
Electrical Characteristics (Ta = 25°C)

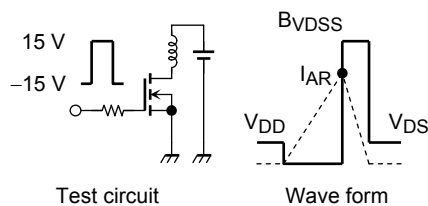
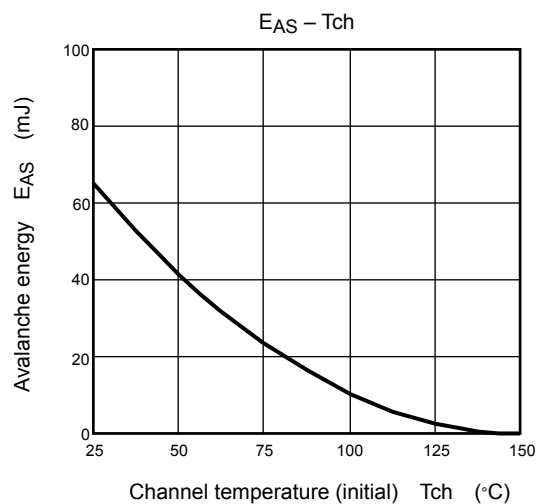
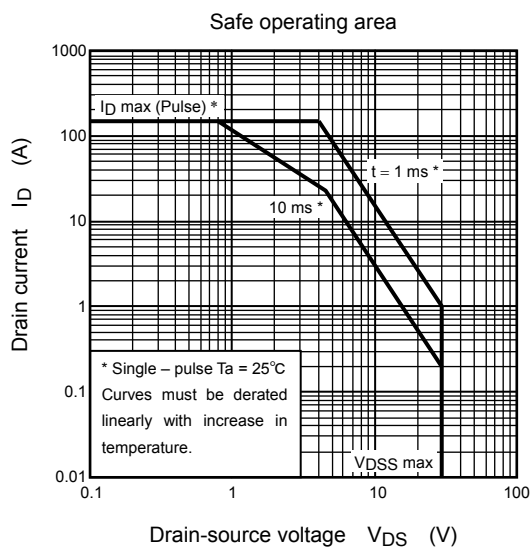
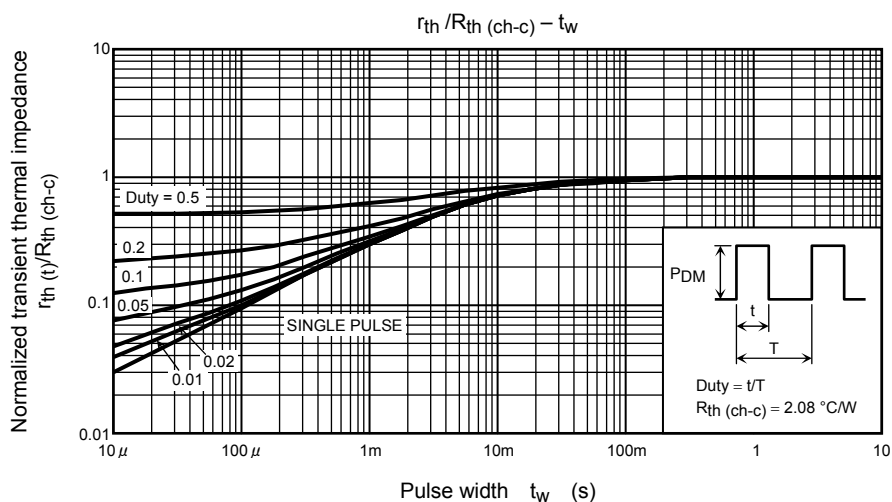
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V	—	—	±100	nA
Drain cutoff current		I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		V _(BR) DSS	I _D = 10 mA, V _{GS} = 0 V	30	—	—	V
		V _(BR) DSX	I _D = 10 mA, V _{GS} = −20 V	15	—	—	
Gate threshold voltage		V _{th}	V _{DS} = 10 V, I _D = 0.2 mA	1.3	—	2.3	V
Drain-source ON-resistance		R _{DS} (ON)	V _{GS} = 4.5 V, I _D = 25 A	—	7.5	9.8	mΩ
			V _{GS} = 10 V, I _D = 25 A	—	5.8	7.5	
Forward transfer admittance		Y _{fs}	V _{DS} = 10 V, I _D = 25 A	45	90	—	S
Input capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	1700	—	pF
Reverse transfer capacitance		C _{rss}		—	125	—	
Output capacitance		C _{oss}		—	380	—	
Gate resistance		r _g	V _{DS} = 10 V, V _{GS} = 0 V, f = 5 MHz	—	1.7	—	Ω
Switching time	Rise time	t _r	 V_{GS} 10 V 0 V I_D = 25 A V_{OUT} 4.7 Ω R_L = 0.6 Ω V_{DD} ≈ 15 V Duty ≤ 1%, t_w = 10 μs	—	20	—	ns
	Turn-on time	t _{on}		—	25	—	
	Fall time	t _f		—	22	—	
	Turn-off time	t _{off}		—	64	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ 24 V, V _{GS} = 10 V, I _D = 50 A	—	25.3	—	nC
			V _{DD} ≈ 24 V, V _{GS} = 5 V, I _D = 50 A	—	13.3	—	
Gate-source charge 1		Q _{gs1}	V _{DD} ≈ 24 V, V _{GS} = 10 V, I _D = 50 A	—	6.3	—	
Gate-drain (“Miller”) charge		Q _{gd}		—	4.6	—	
Gate switch charge		Q _{SW}		—	8.2	—	

Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	150	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 50 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V







$$R_G = 25\ \Omega$$

$$V_{DD} = 24\ \text{V}, L = 20\ \mu\text{H}$$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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